AP Statistics Worksheet Chapter 20 Solutions

1. $H_0 : p = .42$
   $H_A : p > .42$

In order to answer this question, I will need to meet the Independence Assumption and the Sample Size (Normal Distribution) Assumption. In order to meet the Independence Assumption, I will satisfy the:

<u>Randomization Condition</u>: The problem states that the sample was obtained randomly.

<u>10% Condition</u>: It is reasonable to assume the sample is less than 10% of the population of pre-Olympic athletes.

In order to meet the Sample Size (Normal Distribution) Assumption, I will satisfy the:

<u>Success/Failure Condition</u>: np $\geq$10 and nq $\geq$ 10

$454(.42) \geq 10$ and $454(.58) \geq 10$

$190.68 \geq 10$ and $263.32 \geq 10$

Both the number of successes and failures is at least 10

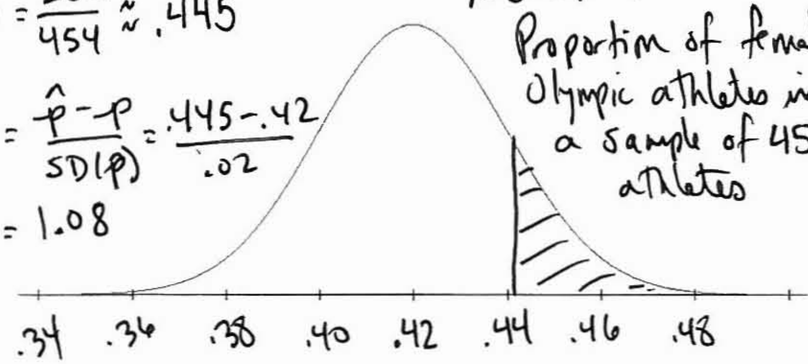
Since I have met all the Assumptions/Conditions, I can now use a Normal Model for the sampling distribution of $\hat{p}$. The sampling distribution will have a mean of .42 and a standard deviation of 0.02 [$SD(\hat{p}) = \sqrt{\frac{p_0 q_0}{n}} = \sqrt{\frac{.42(.58)}{454}} = 0.02$]

$\hat{p} = \frac{202}{454} \approx .445$

$z = \frac{\hat{p} - p}{SD(\hat{p})} = \frac{.445 - .42}{.02} = 1.08$

N(.42, .02)

Proportion of female Olympic athletes in a sample of 454 athletes



P-value $= p(\hat{p} > .445)$
$= p(z > 1.08)$
$= .14$

The P-Value of 0.14 indicates that if the true proportion of female Olympic athletes is .42, then an observed proportion as different as .44 would occur at randomly about 14 times out of 100. With a P-value this large, I FAIL TO REJECT THE NULL. There is not enough evidence to state that the true proportion is not .42. The difference between the null value (.42) and the observed value (.44) is due to random sampling error.

2. $H_0 : p = .166$

$H_A : p > .166$

In order to answer this question, I will need to meet the Independence Assumption and the Sample Size (Normal Distribution) Assumption.

We can meet the Independence Assumption because we can assume that the outcome of flipping one coin does not affect the outcome of the next flip, thus illustrating that the trials are independent.

In order to meet the Sample Size (Normal Distribution) Assumption, I will satisfy the:

Success/Failure Condition: $np \geq 10$ and $nq \geq 10$

$200(.166) \geq 10$ and $200(.834) \geq 10$

$33.2 \geq 10$ and $166.8 \geq 10$

Both the number of successes and failures is at least 10

Since I have met all the Assumptions/Conditions, I can now use a Normal Model for the sampling distribution of $\hat{p}$. The sampling distribution will have a mean of .166 and a standard deviation of 0.026 [$SD(\hat{p}) = \sqrt{\frac{p_0 q_0}{n}} = \sqrt{\frac{.166(.834)}{200}} = 0.026$]

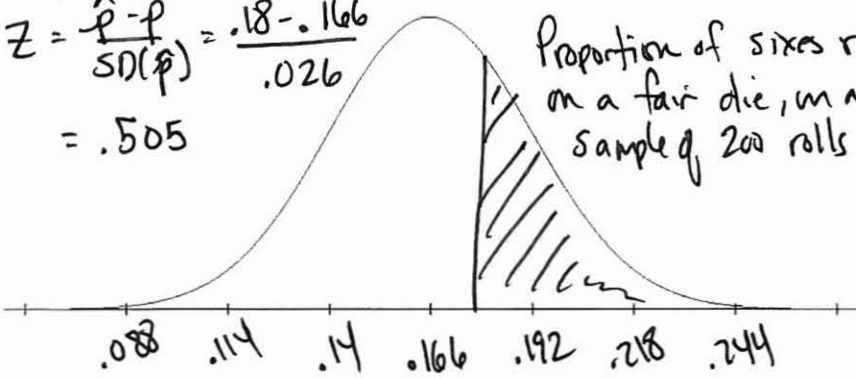
$\hat{p} = .18$

$z = \frac{\hat{p} - p}{SD(\hat{p})} = \frac{.18 - .166}{.026}$

$= .505$

$N(.166, .026)$

Proportion of sixes rolled on a fair die, in a sample of 200 rolls



$\text{P-value} = P(\hat{p} > .18)$

$= P(z > .505)$

$= .307$

A P-value of .307 indicates that if the null is true, obtaining an observed proportion of .18 would not be unlikely. As a result, I FAIL TO REJECT THE NULL. There is not enough evidence to say that the true proportion is not .166. The difference between the observed proportion and the null proportion is due to random sampling error.

3. $H_0 : p = .2$
$H_A : p \neq .2$

In order to answer this question, I will need to meet the Independence Assumption and the Sample Size (Normal Distribution) Assumption. In order to meet the Independence Assumption, I will satisfy the:

<u>Randomization Condition</u>: It is reasonable to assume that the bag was chosen at random from all the bags of M&Ms.

<u>10% Condition</u>: It is reasonable to assume the sample is less than 10% of the population of M&Ms

In order to meet the Sample Size (Normal Distribution) Assumption, I will satisfy the:

<u>Success/Failure Condition</u>: np $\geq$10 and nq $\geq$ 10

122(.2) $\geq$ 10 and 122(.8) $\geq$ 10

24.4 $\geq$10 and 97.6 $\geq$10

Both the number of successes and failures is at least 10

Since I have met all the Assumptions/Conditions, I can now use a Normal Model for the sampling distribution of $\hat{p}$. The sampling distribution will have a mean of .2 and a standard deviation of 0.036 [$SD(\hat{p}) = \sqrt{\frac{p_0 q_0}{n}} = \sqrt{\frac{.2(.8)}{122}} = 0..036$]

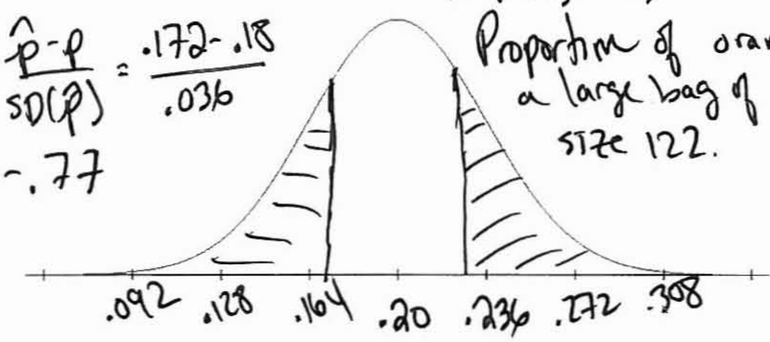
$\hat{p} = \frac{21}{122} \approx .172$

$z = \frac{\hat{p} - p}{SD(\hat{p})} = \frac{.172 - .18}{.036}$

$= -.77$

N(.2, .036)

Proportion of orange m&ms in a large bag of m&ms, of size 122.



$P\text{-value} = 2p(\hat{p} < .172)$

$= 2p(z < -.77)$

$= .4416$

A P-value of .4416 indicates that if the null is true, obtaining an observed proportion of .17 would not be unlikely. As a result, I FAIL TO REJECT THE NULL. There is not enough evidence to say that the true proportion is not .20. The difference between the observed proportion and the null proportion is due to random sampling error.